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## Iran's Nuclear Program: Recent Developments

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### Summary

International Atomic Energy Agency (IAEA) inspections of Iran's nuclear program since 2003 have revealed significant undeclared activities with potential application for nuclear weapons, including uranium enrichment facilities and plutonium separation efforts. Ever on the brink of being declared in violation of the Nuclear Nonproliferation Treaty (NPT), Iran has allowed IAEA inspectors access only when pressed. Iran agreed to suspend its enrichment and reprocessing activities in exchange for promises of assistance from Germany, France, and the UK (EU-3). Negotiations with the EU-3 are ongoing, although on August 1, 2005, Iran told the IAEA of its plans to resume uranium conversion, regardless of what the EU-3 offer. This report will be updated as needed.

### Background

Iran has had a nuclear program for close to 50 years, beginning with a research reactor purchased from the United States in 1959. The Shah's plan to build 23 nuclear power reactors by the 1990s was regarded as grandiose, but not necessarily viewed as a "back door" to a nuclear weapons program, possibly because Iran did not then seek the technologies to enrich or reprocess its own fuel.<sup>1</sup> There were a few suspicions of a nuclear weapons program, but these abated in the decade between the Iranian 1979 revolution and the end of Iran-Iraq war, both of which brought a halt to nuclear activities. Iran's current plans — to construct seven nuclear power plants (1000 MW each) by 2025 — are still ambitious, particularly for a state with considerable oil and gas reserves.<sup>2</sup> Iran argues, as it did in the 1970s, that nuclear power is necessary for rising domestic energy consumption, while oil and gas are needed to generate foreign currency. Few observers

<sup>1</sup> However, there were reports that Iran sought laser enrichment technology in the United States in the late 1970s, and conducted reprocessing-related experiments. In addition, there were intelligence reports that the Shah had a secret group to work on nuclear weapons. See Leonard S. Spector, *Nuclear Ambitions* (Colorado: Westview Press, 1990), p. 204.

<sup>2</sup> See statement by Iran's Foreign Minister Kamal Kharrazi at [[http://www.pbs.org/newshour/bb/middle\\_east/july-dec04/iran\\_9-27.html](http://www.pbs.org/newshour/bb/middle_east/july-dec04/iran_9-27.html)].

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believe that such an ambitious program is necessary or economic for Iran, including the United States.

Iran has asserted repeatedly that its nuclear program is strictly peaceful, stating in May 2003 that “we consider the acquiring, development and use of nuclear weapons inhuman, immoral, illegal and against our basic principles. They have no place in Iran’s defense doctrine.”<sup>3</sup> Iranian officials have also insisted on their right to develop peaceful uses of nuclear technology. President Khatami stated in March 2005 that ending Iran’s uranium enrichment program is “completely unacceptable,” but that Iran would provide “objective guarantees” of the peaceful uses of enrichment. Uranium enrichment can be used for both peaceful (nuclear fuel) and military (nuclear weapons) uses. At the heart of the debate are Iran’s intentions, which have been cast into doubt by revelations of almost two decades of clandestine activities, and whether the international community can adequately verify compliance at enrichment facilities or should further restrict access to sensitive nuclear technologies.

## What Inspections Revealed

In 2002, the National Council of Resistance of Iran (NCR) helped expose Iran’s undeclared nuclear activities by providing information about nuclear sites at Natanz (uranium enrichment) and Arak (heavy water production). In three years of intensive inspections, the IAEA has revealed significant undeclared Iranian efforts in uranium enrichment (including centrifuge, atomic vapor laser isotope separation and molecular laser isotope separation techniques), as well as significant foreign suppliers of technology, undeclared separation of plutonium, and undeclared imported material. Iranian officials have delayed inspections, changed explanations for discrepancies, cleaned up facilities and in one case, Lavizan-Shian, razed a site.<sup>4</sup> According to IAEA Director General Mohamed ElBaradei, “Iran tried to cover up many of their activities, and they learned the hard way.”<sup>5</sup> Only in January 2005 did Iranian officials share a copy of Pakistani scientist A.Q. Khan’s 1987 offer of a centrifuge enrichment “starter kit.”<sup>6</sup>

Iran failed to report not just activities, but also material imports (including uranium imported from China in 1991) Undeclared uranium imports (a U.S. concern with respect to Iraq in 2003) raise a red flag since further experiments with the material, particularly those relevant to nuclear weapons could be hidden more easily if the material is undeclared.<sup>7</sup> Iran did experiment, converting some uranium into metal and using other uranium in isotope production, purification and conversion processes, some of which are relevant to plutonium reprocessing (e.g., dissolution in nitric acid and separation in a pulse

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<sup>3</sup> Statement by H.E. Mr. G. Ali Khoshroo, Deputy Foreign Minister for Legal and International Affairs, Second Session of the Prepcom for the 2005 NPT Review Conference, Apr. 29, 2003.

<sup>4</sup> David Albright and Corey Hinderstein, “Iran: Countdown to showdown,” *Bulletin of Atomic Scientists*, Nov./Dec. 2004, vol. 60, no. 6.

<sup>5</sup> “Iran Was Offered Nuclear Parts,” *Washington Post*, Feb. 27, 2005.

<sup>6</sup> Ibid.

<sup>7</sup> Iran imported, but did not declare, 1800 kilograms of natural uranium in different forms: uranium hexafluoride (UF<sub>6</sub>), which is used in centrifuge enrichment; uranium tetrafluoride (UF<sub>4</sub>); and uranium oxide (UO<sub>2</sub>).

column).<sup>8</sup> In mid-2003, Iran admitted it conducted “bench scale” uranium conversion experiments a decade ago (required to be reported to the IAEA) and later, admitted that it used for those experiments some safeguarded material that had been declared lost in other processes (a safeguards violation). In February 2004, the IAEA concluded that, “given the size and capacity of the equipment used, the possibility cannot be excluded that larger quantities of nuclear material could have been involved than those declared.”<sup>9</sup> The IAEA has deemed credible Iran’s explanation that it needed to convert uranium into metal for its laser uranium enrichment program (revealed only in October 2003).

**Enrichment Activities.** Inspections revealed two enrichment plants at Natanz — a pilot-scale (planned to have 1000 centrifuges) facility and a commercial-scale plant under construction (planned to have 50,000 centrifuges). The pilot-scale plant started up in June 2003 only to shut down after Iran suspended enrichment activities in December 2003. Construction on the commercial-scale plant has also been suspended. The plants are built partly underground, raising concerns about intentions. Several questions have been raised in connection to those plants in the course of inspections:

***Did Iran introduce uranium gas (process gas, or UF<sub>6</sub>) into the pilot-scale plant?*** If so, the slight enrichment of uranium that would have resulted would have been a safeguards violation if undeclared. Iranian officials told the IAEA that it was too difficult to use process gas, but that Iran was able nonetheless to advance to a production stage of centrifuge enrichment.<sup>10</sup>

***Where did the highly enriched uranium (HEU) particles come from?*** Iranian officials asserted that highly enriched uranium (HEU) particles found at the Natanz pilot plant in 2003 came from contamination from foreign-origin centrifuge assemblies, which was the first clue revealing the Pakistani A.Q. Khan network as supplier of some centrifuges to Iran. Iran admitted to enriching uranium to just 1.2%, while the particles sampled ranged from 36% U-235 to 70% U-235 enrichment. In October 2003, Iranian officials admitted they tested centrifuges at the Kalaye Electric Company using UF<sub>6</sub> between 1998 and 2002. The IAEA did not rule out the possibility that Iran’s own enrichment activities could be the source of the HEU in samples.

***Why did Iran keep other information hidden?*** Iran has been particularly slow to reveal the existence of more sophisticated centrifuge designs (using maraging steel or composite rotors) and its laser enrichment program. Iran provided significant detail about the P-1 centrifuges in its October 2003 declaration, but it did not admit until asked by the IAEA in January 2004 that it possessed more advanced centrifuge designs (P-2). In light of Libya’s admission that Pakistan supplied it with P-2 centrifuge designs, Iran’s possession of P-2 designs is not surprising. Iran also did not admit until October 2003 that

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<sup>8</sup> *Implementation of the NPT Safeguards Agreement in the Islamic Republic of Iran*, Report by the Director General, GOV/2003/75, Nov. 10, 2003 (title referred hereafter to as “Iran”).

<sup>9</sup> *Iran*, Report by the Director General, GOV/2004/11, Feb. 24, 2004.

<sup>10</sup> *Iran*, Report by the Director General, GOV/2003/40, June 6, 2003.

it also pursued a laser enrichment program beginning in the 1970s, focusing on two techniques.<sup>11</sup>

**Plutonium-Related Activities.** In October 2003 Iran revealed that it had conducted plutonium reprocessing experiments in a hot cell at the Tehran Nuclear Research Center and estimated the amount separated as 200 micrograms. The IAEA calculated that more plutonium would have been produced (about 100g) and Iran admitted in May 2004 that it understated the amount. Inspections also revealed that Iran experimented between 1989 and 1993 on irradiating bismuth, which can be used to produce Polonium-210 for civilian purposes (for nuclear batteries) or in conjunction with beryllium to create a neutron initiator for a nuclear weapon. Polonium, according to many observers, is not ideal for nuclear weapons purposes.

The heavy water program also has raised questions about Iran's intentions. Reportedly, Iran first told the IAEA that it planned to produce heavy water for export, then told the Agency that the heavy water would be used as a coolant and moderator for a planned IR-40 reactor for research and development, radioisotope production, and training. Subsequently, Iran's design information for the facility omitted necessary hot cell equipment for producing radioisotopes, which the Agency asked Iran to clarify, given reports of Iranian efforts to import hot cell equipment. Construction of the heavy water reactor has continued into 2005, despite the Board's call for a halt in 2004. The foundation of the reactor has been poured, and the heavy water production plant may soon produce heavy water.<sup>12</sup>

## NPT Compliance Issues

The IAEA has not yet found Iran in noncompliance with its NPT obligations. Since early 2003, the Director General (DG) has made special reports to the Board of Governors, which have called upon Iran to take certain actions. At the March 2005 Board of Governors meeting, DG ElBaradei refrained from making a special report and instead let the deputy director for safeguards report on Iran's progress. This had the effect of de-escalating issues related to Iran's compliance.

**Procedures and Practice.** Noncompliance with the NPT is fundamentally noncompliance with a nuclear safeguards agreement. According to the IAEA Statute, if inspectors find a state in noncompliance with its safeguards agreement, they report that to the Director General, who informs the Board of Governors. The Board informs all IAEA member states, the UN Security Council, and the General Assembly.<sup>13</sup> In the case of Iran, the DG has not yet found Iran in noncompliance with its safeguards agreement, despite numerous discrepancies. Since 2003, the United States has maintained that "the facts already established would fully justify an immediate finding of noncompliance by Iran

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<sup>11</sup> "Iran Said To Be Stepping Up Effort to Support Laser Enrichment Program, *Nuclear Fuel*, October 5, 1998.

<sup>12</sup> For analysis, see [<http://www.isis-online.org/publications/iran/arakconstruction.html>].

<sup>13</sup> For text of the Statute, see [[http://www.iaea.org/About/statute\\_text.html#A1.12](http://www.iaea.org/About/statute_text.html#A1.12)].

with its safeguards obligations.”<sup>14</sup> There is considerable room for interpretation, both by IAEA inspectors and the DG. In one respect, this may be considered necessary, because, for example, failures to report material can be significant or trivial, depending on the circumstances. Discrepancies involving large quantities of weapons-grade plutonium or highly enriched uranium are clearly more significant for a nuclear weapons program than those involving smaller quantities or non-weapons grade materials like natural uranium. However, many hold that discrepancies establish a pattern of deception that is significant.

**Board of Governors Actions.** The first step the Board took was in September 2003, calling on Iran to suspend all further uranium enrichment and reprocessing activities, resolve all outstanding issues, be transparent and cooperative with the IAEA, and sign, ratify and implement the Additional Protocol. Iran responded by agreeing to sign the Additional Protocol and voluntarily suspend all uranium enrichment and “processing activities.” The suspension covered: operation and/or testing of centrifuges at the pilot plant, further introduction of any nuclear material into any centrifuges, and installation of new centrifuges at the pilot plant and at Natanz. Iran also said it would withdraw nuclear material from any centrifuge facility to the extent practicable.<sup>15</sup> During the period of suspension, Iran said it did not “intend to make new contracts for the manufacture of centrifuge machines and their components;” that the Agency could supervise the storage of machines assembled during that period; that it had dismantled its laser enrichment projects and that it was not constructing or operating any plutonium separation facility. Yet, Iran reportedly continued to assemble centrifuges.

The Board resolved in November 2003 (GOV/2003/81) that “should any further serious Iranian failures come to light, the Board of Governors would meet immediately to consider...all options at its disposal, in accordance with the IAEA Statute and Iran’s Safeguards Agreement.” Between February and June 2004, the IAEA attempted to verify Iran’s pledges to suspend activities. The DG reported in March 2004 that Iran had been actively cooperating with the Agency, including providing access to workshops at military sites, but that Iran failed to mention advanced centrifuge designs (P-2) in its October 2003 declaration and the Agency was not able to resolve the major outstanding issue of LEU and HEU contamination at Kalaye and Natanz. The June 2004 report (GOV/2004/34) assessed that Iran had delayed inspections at the Natanz pilot scale enrichment plant; Iran had not suspended UF<sub>6</sub> production or domestic production of centrifuge components; and Iran had not previously declared the procurement of 4000 magnets (and orders for more) for P-2 centrifuges. While the Board noted (GOV/2004/49) with concern continuing discrepancies about HEU contamination and the nature of the P-2 centrifuge program and called upon Iran to halt UF<sub>6</sub> production and planned construction of the research reactor designed to use heavy water, the resolution noted only the Board would remain seized of the matter. In March 2005, Iran was reported to continue the production of UF<sub>4</sub>, as well as quality control testing on centrifuge components. The March 2005 Board, however, did not issue a resolution on Iran.

**EU-3 Negotiations.** Since October 2003, the foreign ministers of Germany, France, and the UK (EU-3) have been negotiating with Iran on restricting its nuclear

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<sup>14</sup> Statement of Ambassador Kenneth Brill at September 2003 IAEA Board of Governors Meeting.

<sup>15</sup> GOV/2004/11, February DG’s report on Iran, p. 10.

program in exchange for wide-ranging assistance. If EU-3 negotiations fail, it is not clear even then that the IAEA would call Iran into noncompliance, since the Iranian suspension is voluntary. Reportedly, the EU-3 agreed with the United States in May to call for UN Security Council action if their negotiations with Iran fail.<sup>16</sup> Negotiations seem to be failing to obtain Iran's agreement on a key objective — a permanent halt to uranium enrichment activities. In March 2005, Iran proposed running its pilot-scale enrichment facility, which EU-3 negotiators rejected. In April 2005, Iran said it would start-up its uranium conversion plant unless negotiations progressed. A top Iranian negotiator told the press that the EU “would have to offer significant incentives like a deal for 10 nuclear reactors.”<sup>17</sup> Iran demanded a new negotiating proposal by July 31, but the EU-3 delayed, arguing that the incoming Iranian president would be better able to respond in August. On August 1, Iran informed the IAEA it would resume uranium conversion, stating that since uranium conversion was not considered by the IAEA to be enrichment, this would not violate its voluntary suspension.<sup>18</sup>

## Significance for a Nuclear Weapons Program

Iran is likely years away from producing weapons-grade plutonium or highly enriched uranium. Vice Adm. Jacoby, director of the Defense Intelligence Agency, told the Senate Armed Services Committee in March 2005 that Iran is expected to be able to produce a weapon early next decade. According to one report, the new National Intelligence Estimate on Iran assesses that it will be ten years before Iran has a bomb.<sup>19</sup> That said, Iran has pursued three different methods of enriching uranium and has experimented with separating plutonium, suggesting a steady accrual of expertise in weapons-relevant areas, according to some observers. If Iran received the same nuclear weapon design that A.Q. Khan gave Libya, the remaining technical hurdle (albeit the most difficult) would be fissile material production. A key challenge is verifying that there are no undeclared enrichment facilities or capabilities. Although some NPT members may feel that enhanced inspections under the Additional Protocol will be enough to verify compliance, others feel that access to enrichment and reprocessing technologies must be restricted.

Some observers are concerned about the potential for the Bushehr and the heavy-water-moderated IR-40 reactors to be used for clandestine plutonium production. In addition to IAEA safeguards on these reactors, Iran must also send Bushehr's spent fuel back to Russia for disposal under a 2005 agreement, which according to some observers, could provide further assurances of non-diversion.

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<sup>16</sup> “Europeans Agree To Meeting With Iran On Nuclear Program,” *Washington Post*, May 17, 2005.

<sup>17</sup> “Iran Seeks Incentives from Europe in Nuclear Impasse,” *New York Times*, May 19, 2005.

<sup>18</sup> INFCIRC/648, *Communication dated 1 August 2005 received from the Permanent Mission of the Islamic Republic of Iran to the Agency*. Available at [<http://www.iaea.org>]

<sup>19</sup> “Iran is Judged 10 Years From Nuclear Bomb,” *Washington Post*, August 2, 2005.